CLAIMS

1. A method for producing a silicon wafer, comprising:

a silicon crystal production step of producing a silicon crystal while controlling the concentration of boron in the silicon crystal and the growth condition V/G (where V is the growth rate, and G is the temperature gradient in the crystal axis direction) so as to fall within an epitaxial defect-free region ($\alpha 2$) which is a defect-free region in which a silicon wafer substrate is free of defects and an epitaxial growth layer is free of defects and which has a lower limit line (LN1) in which, at the boron concentration in the silicon crystal of 1×10^{18} atoms/cm^3 and above, the growth rate V gradually decreases as the boron concentration rises;

a silicon wafer substrate obtaining step of obtaining the silicon wafer substrate from the silicon crystal; and

an epitaxial growth step of forming the epitaxial growth layer on the silicon wafer substrate.

2. The silicon wafer production method according to claim 1, characterized in, in the silicon crystal production step, making the temperature gradient G in the silicon crystal axis direction uniform to within a given degree between a center of the crystal and an edge of the crystal.

3. The silicon wafer production method according to claim 2, characterized in, in the silicon crystal production step, applying a magnetic field to a silicon melt from which the silicon crystal is pulled, thereby making the temperature gradient G in the silicon crystal axis direction uniform to within a given degree between the center of the crystal and the edge of the crystal.

4. The silicon wafer production method according to claim 2, characterized in, in the silicon crystal production step, bringing the silicon melt from which the silicon crystal is pulled to a magnetic field-free state and controlling the number of rotations of the silicon crystal, thereby making the temperature gradient G in the silicon crystal axis direction uniform to within a given degree between the center of the crystal and the edge of the crystal.

5. The silicon wafer production method according to claim 2, characterized in, in the silicon crystal production step, bringing the silicon melt from which the silicon crystal is pulled to a magnetic field-free state and controlling the number of rotations of a quartz crucible holding the silicon melt, thereby making the temperature gradient G in the silicon crystal axis direction uniform to within a given degree between the center of the crystal and the edge of the crystal.

6. The silicon wafer production method according to claim 1, characterized in, in the silicon crystal production step, controlling the oxygen concentration in the silicon crystal to no more than 12.5 atoms/cm^3.

7. The silicon wafer production method according to claim 2, characterized in, in the silicon crystal production step, controlling the oxygen concentration in the silicon crystal to no more than 12.5 atoms/cm^3.

8. A method for producing a silicon wafer, characterized in controlling the boron concentration in the silicon crystal and the growth condition V/G (where V is the growth rate, and G is the temperature gradient in the crystal axis direction) so as to include at least an epitaxial defect region ($\beta 1$) in which oxidation-induced stacking faults (OSF) occur in a

silicon wafer substrate and defects occur in an epitaxial growth layer, and in controlling the silicon crystal heat treatment conditions and the oxygen concentration in the silicon crystal so that no OSF nuclei develop into OSFs.

9. A method for producing a silicon wafer, comprising:

a silicon crystal production step of producing a silicon crystal while controlling a boron concentration in the silicon crystal and a growth condition V/G (where V is a growth rate, and G is a temperature gradient in a crystal axis direction) so as to fall in the vicinity of a lower limit line (LN3) within an epitaxial defect-free region (α1) in which void defects occur in a silicon wafer substrate and an epitaxial growth layer is free of defects;

a silicon wafer substrate obtaining step of obtaining the silicon wafer substrate from the silicon crystal; and

an epitaxial growth step of forming a thin-film epitaxial growth layer of no more than 2 μm on the silicon wafer substrate.

10. The silicon wafer production method according to claim 9, characterized in, in the silicon crystal production step, controlling the oxygen concentration in the silicon crystal to no more than 12.5 atoms/cm^3.